



## Overview

### Points To Remember About Growth Plate Injuries

- Injuries to the growth plate happen when a break or fracture occurs near or at the end of a long bone.
- Growth plate injuries happen to children and teens.
- Most growth place injuries occur after a sudden accident, such as falling or having a hard hit to the limb.
- Doctor's test for growth plate injuries by asking about the injury, examining your child, and ordering x-rays.
- Treatment may include using a cast or splint, setting the bones back in place, exercises, and long-term follow up.
- Most growth plate injuries get better and do not cause any lasting problems for your child or teen.

The growth plate, also known as the epiphyseal plate or physis, is the area of growing tissue near the ends of the long bones in children and adolescents.

Each long bone has at least two growth plates; one at each end. The growth plate determines the future length and shape of the mature bone. Once your child's growth is complete – sometime during adolescence – the growth plates close and are replaced by solid bone.

The growth plates are the weakest areas of your child's growing skeleton. Because they are even weaker than the nearby ligaments and tendons that connect bones to other bones and muscles, growth plates are vulnerable to injury. Injuries to the growth plate are called fractures.

## Who Gets

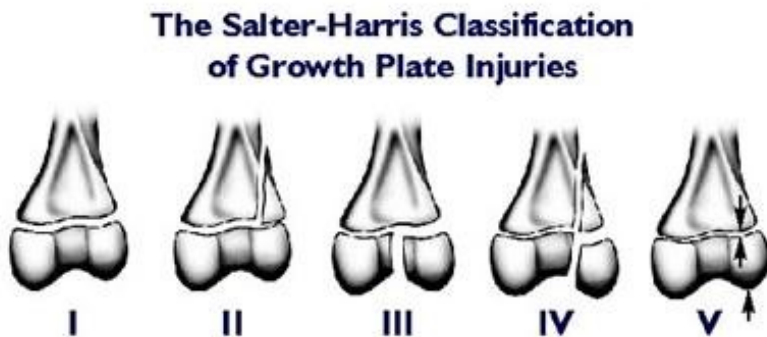
Growth plate injuries are more likely to occur:

- In growing children and teens. When your child or teen injures a joint, they are more likely to fracture the growth plate. A similar injury in an adult would cause a sprain.
- Growth plate fractures occur twice as often in boys as in girls. A girl's body matures at an earlier age than boys. As a result, girls' bones finish growing sooner. When the growth plates finish growing, they are replaced by stronger, solid bone.
- Growth plate injuries often occur in children and teens who participate in competitive sports or activities such as:
  - Football.
  - Basketball.
  - Gymnastics.
  - Biking.
  - Sledding.
  - Skiing.
  - Skateboarding.

Fractures can result from a single traumatic event, such as a fall or automobile accident, or from chronic stress and overuse. Most growth plate fractures occur in the long bones of the fingers (phalanges) and the outer bone of the forearm (radius). They are also common in the lower bones of the leg (the tibia and fibula).

## Types

Depending on the type of damage, the Salter-Harris classification divides most growth plate fractures into five categories:



Adapted from Disorders and Injuries of the Musculoskeletal System, 3rd Edition. Robert B. Salter, Baltimore, Williams and Wilkins, 1999. Used with the author's permission.

- Type I is a fracture through the growth plate and happens when the epiphysis is completely separated from the end of the bone, through the deep layer of the growth plate. The growth plate remains attached to the epiphysis. The doctor may have to put or set the fracture back into place if it is significantly displaced. Type I injuries generally require a cast to protect the plate as it heals. Unless there is damage to the blood supply to the growth plate, the likelihood that the bone will grow normally is excellent.

- Type II is a fracture that runs through the growth plate and metaphysis, but not through the epiphysis. This is the most common type of growth plate fracture. Type II fractures may need the doctor to set the bones and immobilize the injury. However, this type of injury can heal quickly younger children and the doctor may not need to set the bone back into position. If this is the case, the injury heals and strengthens with time.
- Type III fractures run through growth plate leading to a separation of epiphysis and growth plate from the metaphysis. This type of injury rarely happens. However, when this type of fracture occurs, it is usually at the lower end the long bones of the lower leg. Surgery is sometimes necessary to restore the joint surface to normal. The outlook or prognosis for growth is good if the blood supply to the separated portion of the epiphysis is still intact and if the joint surface heals in a normal position.
- Type IV fractures run through the growth plate, metaphysis, and epiphysis. Doctors frequent need to perform surgery to restore the joint surface to normal and to perfectly align the growth plate. If perfect alignment isn't achieved and maintained during healing, prognosis for growth is poor, and angulation (bending) of the bone may occur. This injury occurs most commonly at the end of the humerus (the upper arm bone) near the elbow.
- Type V is a compression fracture through the growth plate that happens when the end of the bone is crushed and the growth plate is compressed. This injury isn't common. However, when it happens, it is most likely to occur at the knee or ankle. The prognosis isn't as good as the other type of fractures because premature stunting of growth almost always occurs.
- Type VI fractures are included in a newer classification, called the Peterson classification. This injury happens when a portion of the epiphysis, growth plate, and metaphysis are missing. This usually occurs with open wounds or compound fractures. A type VI growth plate injury often involves lawn mowers, farm machinery, snowmobiles, or gunshot wounds. All children or teens with a type VI fracture require surgery, and most require additional reconstructive or corrective surgery. Bone growth is almost always stunted.

## Symptoms

Your child or teen could have symptoms of growth plate injury when your child:

- Complains of persistent pain after a sudden injury.
- Limits the amount of time playing after an old injury.
- Has changes in the way their limb bends.
- Cannot move a limb because of pain.
- Has persistent pain after an overuse injury.

Whether an injury is acute or due to overuse, your child or teen should see a doctor for evaluation. Some injuries, if left untreated, can lead to permanent damage and interfere with proper growth of the injured limb.

## Causes

Growth plate injuries happen for many reasons. Most occur after a sudden accident, such as falling or having a hard hit to the limb. The most common cause of growth plate injuries includes:

- Trauma to the limb from a blow or falling down.
- Competitive sports (like football).
- Recreational activities.

Sometimes growth plate injuries happen when your child overuses a certain part of the body. For example:

- Gymnasts who practice for hours on the uneven bars.
- Long-distance runners.
- Baseball pitchers perfecting their curve balls.

Although many growth plate injuries are caused by accidents that occur during play or athletic activity, growth plates are also susceptible to other disorders that can alter their normal growth and development. Other possible causes of growth plate injuries include the following:

- Bone infections.
- Child abuse.
- Injury from extreme cold (for example, frostbite).
- Radiation and medications.
- Neurological disorders.
- Genetics.
- Metabolic disease.

## Diagnosis

Doctor's diagnose growth plate injuries by

- Asking about the injury and how it occurred.
- Examining your child.
- Ordering x-rays.

Often the doctor will x-ray your child's injured limb and the opposite limb as well. Because growth plates have not yet hardened into solid bone, neither the structures themselves nor injuries to them show up on x-rays. Instead, growth plates appear as gaps between the shaft of a long bone, called the metaphysis, and the end of the bone, called the epiphysis. By comparing x-rays of your child's injured limb to those of their noninjured limb, doctors can look for differences that indicate an injury.

Very often the x-ray is negative, because the growth plate line is already there, and the fracture is undisplaced (the two ends of the broken bone are not separated). The doctor can still diagnose a growth plate fracture on clinical grounds because of tenderness of the plate. Children do get ligament strains if their growth plates are open, and they often have undisplaced growth plate fractures.

Other tests doctors may use to diagnose your child's growth plate injury include:

- Magnetic resonance imaging (MRI).
- Computed tomography (CT).
- Ultrasound.

Because these tests enable doctors to see the growth plate and areas of other soft tissue, they can be useful not only in detecting the presence of an injury, but also in determining the type and extent of the injury.

## **Treatment**

Treatment for growth plate injuries depends on the type of injury. In all cases, treatment should be started as soon as possible after injury and will generally involve a mix of the following:

### **Immobilization**

The doctor puts the injured limb in a cast or splint, and your child or teen is told to limit any activity that puts pressure on the injured area.

### **Manipulation or Surgery**

If the your child's fracture is displaced (meaning the ends of the injured bones no longer meet as they should), the doctor will have to put or set the bones or joints back in their correct positions. Doctors do this by

- Manipulation. The doctor uses his or her hands to set the bone.
- Performing surgery. Sometimes the doctor needs to fix the break and hold the growth plate in place with screws or wire. After the procedure, the bone will be set in place (immobilized) so it can heal without moving. This is usually done with a cast that encloses the injured growth plate and the joints on both sides of it.

After manipulation or surgery, the doctor places a case on the injured area. The cast is left in place until the injury heals, which can take anywhere from a few weeks to 2 or more months for serious injuries.

The need for manipulation or surgery depends on the location and extent of the injury, its effect on nearby nerves and blood vessels, and the child's age.

## Strengthening and Range-of-Motion Exercises

Your child's doctor may recommend exercises to strengthen the muscles that supports the injured area of the bone. Strengthening can help to improve your child's ability to move the joint in the way that it should. Doctor's usually recommend these after the fracture has healed. A physical therapist can work with your child and his or her doctor to design an appropriate exercise plan. Long-term follow-up is usually necessary to monitor the child's recuperation and growth.

## Who Treats

For all but the simplest injuries, your child's doctor will probably refer him or her to an orthopaedic surgeon (a doctor who specializes in bone and joint problems in children and adults) for treatment. Some problems may require the services of a pediatric orthopaedic surgeon, who specializes in injuries and musculoskeletal disorders in children.

## Disease Course

Most growth plate fractures heal without any lasting effect. However, some children experience complications. The most frequent complication of a growth plate fracture is premature arrest or a stop of bone growth. Whether your child experiences an arrest in growth depends on the type of treatment your child received and the following factors:

- Severity of the injury. If your child's injury causes the blood supply to the epiphysis to be cut off, growth can be stunted. If the growth plate is shifted, shattered, or crushed, the growth plate may close prematurely, forming a bony bridge or "bar." The risk of growth arrest is higher in this setting. An open injury in which the skin is broken carries the risk of infection, which could destroy the growth plate.
- Age of your child. In a younger child, the bones have a great deal of growing to do; therefore, growth arrest can be more serious, and closer surveillance is needed. It is also true, however, that younger bones have a greater ability to heal.
- Which growth plate is injured. Some growth plates, such as those in the region of the knee, are more involved in extensive bone growth than others.
- [Type of fracture. Of the six fracture types described earlier, types IV, V, and VI are the most serious.](#)

If your child experiences an arrest in bone growth, they could have one limb shorter than the uninjured limb. If only part of the growth plate is injured, growth may be lopsided and the limb may become crooked.

Growth plate injuries at the knee have the greatest risk of complications. Nerve and blood vessel damage occurs most frequently there. Injuries to the knee have a much higher incidence

of premature growth arrest and crooked growth.

## Research Progress

Researchers supported by the National Institutes of Health continue to seek better ways to diagnose and treat growth plate injuries and to improve patient outcomes. Examples of such work include:

- Investigating the factors that regulate growth plate chondrocytes. These cells are essential to growth at the ends of the bones.
- Exploring the molecular mechanisms regulating growth plate development and the mechanisms responsible for growth.
- Identifying strategies for protecting the growth plate during radiation treatment.
- Identifying predictors for premature closure of the growth plate following fractures. By predicting the injuries most likely to result in arrested growth, doctors could opt to treat them differently and more aggressively.
- Development of methods to regenerate musculoskeletal tissue by using principles of tissue engineering.

## Related Resources

### **U.S. Food and Drug Administration**

Toll free: 888-INFO-FDA (888-463-6332)

Website: <https://www.fda.gov>

Drugs@FDA at <https://www.accessdata.fda.gov/scripts/cder/daf>. Drugs@FDA is a searchable catalog of FDA-approved drug products.

### **Centers for Disease Control and Prevention, National Center for Health Statistics**

Website: <https://www.cdc.gov/nchs>

### **American Academy of Orthopaedic Surgeons**

Website: <https://www.aaos.org>

### **American Academy of Pediatrics**

Website: <https://www.aap.org>

### **American Orthopaedic Society for Sports Medicine**

Website: <https://www.sportsmed.org>

If you need more information about available resources in your language or other languages, please visit our webpages below or contact the NIAMS Information Clearinghouse at [NIAMSInfo@mail.nih.gov](mailto:NIAMSInfo@mail.nih.gov).

- [Asian Language Health Information](#)
- [Spanish Language Health Information](#)

## **Join a Clinical Trial**

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## **Related Information**

[Lesiones deportivas: Esenciales: hojas informativas de fácil lectura](#)

[Los niños y sus huesos: una guía para los padres /Kids and Their Bones: A Guide...](#)

[¿Qué son las lesiones en las placas de crecimiento? \(Esenciales: hojas informativas\)](#)

[Healthy Bones Matter: Kids' Fact Sheet](#)

## **View/Download/Order Publications**

[Growth Plate Injuries, Easy-to-Read Fast Facts](#)

[Growth Plate Injuries, Questions and Answers about](#)

[Preventing Musculoskeletal Sports Injuries in Youth: A Guide for Parents](#)

[Kids and Their Bones: A Guide for Parents](#)